



Billing Code: 3510-13

## **DEPARTMENT OF COMMERCE**

### **National Institute of Standards and Technology**

#### **Notice of Localization and Tracking System Testing Consortium**

**AGENCY:** National Institute of Standards and Technology.

**ACTION:** Notice of Research Consortium.

**SUMMARY:** The National Institute of Standards and Technology (NIST), an agency of the United States Department of Commerce, is establishing the Localization and Tracking System (LTS) Testing Consortium and invites organizations to participate in this Consortium. Participants in this Consortium will have the opportunity to test their LTS leveraging a unique capability on the NIST Gaithersburg campus. The goals of the LTS Testing Consortium are to demonstrate and further develop standardized localization and tracking system testing procedures, and to assess current state of the art. The LTS Testing Consortium will not evaluate whether any individual system is commercially feasible. Participants in the Consortium will be required to sign a Cooperative Research and Development Agreement (CRADA).

**DATES:** Letters of interest for participation in this LTS Testing Consortium will be accepted until **December 15, 2017**. LTS testing is expected to occur in April or May 2018, with a pre-event workshop in February, however dates are subject to change.

**ADDRESSES:** Letters of interest and requests for additional information can be directed to the NIST LTS Testing Consortium Manager, Nader Moayeri, of the Advanced Network Technologies Division of NIST's Information Technology Laboratory. Nader Moayeri's contact information are NIST, 100 Bureau Drive, Stop 8920, Gaithersburg, MD 20899-8920, USA, e-mail: [nader.moayeri@nist.gov](mailto:nader.moayeri@nist.gov), and telephone: +1 301-975-3767.

**FOR FURTHER INFORMATION CONTACT:** For further information regarding the terms and conditions of NIST's CRADA, please contact Jeffrey DiVietro, CRADA and License Officer, NIST's Technology Partnerships Office, by mail to 100 Bureau Drive, Mail Stop 2200, Gaithersburg, Maryland 20899-2200, by e-mail to [jeffrey.divietro@nist.gov](mailto:jeffrey.divietro@nist.gov), or by telephone at +1 301-975-8779.

#### **SUPPLEMENTARY INFORMATION:**

**Consortium Objectives:** ISO/IEC JTC 1/SC 31<sup>1</sup> has developed the international standard, ISO/IEC 18305, "Test and evaluation of localization and tracking systems" that addresses test methods with performance metrics and considers environmental factors and usage scenarios expected in the field. NIST's objectives under this LTS Testing

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<sup>1</sup> International Organization of Standardization / International Electrotechnical Commission / Joint Technical Committee 1 / Subcommittee 31

Consortium are to plan and conduct Test and Evaluation (T&E) activities based on ISO/IEC 18305. Goals of the T&E activities include:

1. Assessment of ISO/IEC 18305 to identify improvements that can be incorporated into the next version of the standard; and
2. Assessment of LTS technologies using the standardized test methods of ISO/IEC 18305 for the dual purposes of comparing technologies to identify strengths and weaknesses of various technological approaches and solutions, and to make it possible for Consortium Members to use that information as a basis for further developing their LTS. The results from the LTS Testing Consortium will allow the validation of ISO/IEC 18305. The results will also allow setting minimum performance requirements for various applications of LTS technology and enable comparisons based on common test methods. Results from this research are expected to improve the performance of LTS technologies.

**Background Information:** Indoor localization is the capability to determine/estimate the location of an entity to be localized or tracked (ELT), such as a person, a robot, or some other object equipped with an appropriate electronic device<sup>2</sup> in buildings and subterranean structures such as tunnels, caves, and underground mines. Tracking is the capability to estimate the location of such ELT on an ongoing basis and making the location information available to a tracking authority. Localization and tracking, whether indoors or outdoors, has applications in a wide range of domains including public safety, manufacturing, construction, health care, entertainment, social networking, building automation, and defense.

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<sup>2</sup> It is also possible to have such capability using cameras installed in the environment. In that case, there is no need for the person, robot, or other object to be equipped with an electronic device. However, such imaging-based techniques are beyond the scope of the LTS Testing Consortium.

Testing a LTS is complicated for several reasons:

- There are many categories of LTS. Some rely on presence of electronic infrastructure in the environment (building/tunnel/cave/underground mine) to facilitate localization and tracking. Some systems require site-specific training and calibration before they can be used. Some systems need to have access to the floor plans of the building or need to know the global coordinates of its boundaries to operate. Therefore, one must be careful when comparing the performance of various systems to ensure the comparisons are fair.
- A LTS often has RF components. RF propagation can vary considerably from one building to another depending on the construction material used in the building, its floor plans, and objects present in the building. Therefore, the LTS must be tested in a variety of buildings, including a high rise, because a LTS typically has more difficulty in estimating the floor where the ELT is located than in estimating its horizontal location.
- Given that the inertial sensors present in ubiquitous smartphones and other devices used for localization suffer from “drift” that worsens over time, it is important to test the LTS using long test scenarios, complex paths, different modes of mobility (e.g., walking, running, sidestepping, walking backwards, and crawling) and speeds of movement. Therefore, the use of large buildings is a prerequisite for a well-designed testing procedure.

Considering the complexities of indoor localization testing above, vendors may not have the opportunity to test their LTS in a thorough and comprehensive manner. Therefore, potential users may be unable to determine whether a given LTS meets their needs. These

issues demonstrate the need for standardized testing procedures that can be used to test and compare localization and tracking systems.

**Test and Evaluation (T&E) Activities:** NIST intends to hold a pre-event workshop for participants of the Consortium to prepare for the T&E activities. NIST anticipates the test event will take place over a period of two weeks (ten business days) about two months after the workshop. Each LTS will be tested over the course of 3-5 days during one of the two weeks. During the two-week T&E event, each LTS will be tested under NIST supervision by the participating company staff members according to the procedures of ISO/IEC 18305. Lessons learned from testing will be used to make modifications to the testing procedures and corresponding future revisions in ISO/IEC 18305. Going forward, NIST intends to use the same set of buildings so that future testing will indicate the industry's improvements in performance of indoor localization and tracking systems. Participation in this LTS Testing Consortium does not guarantee participation in future testing activities.

**Methodology:** To the extent possible, NIST has chosen structures on its Gaithersburg, MD campus according to the guidelines specified in ISO/IEC 18305. NIST has instrumented the structures with one-inch diameter, circular floor markers. Locations of the floor markers have been surveyed by a professional surveying company using precision laser surveying equipment. In addition, the locations of ~200 Wi-Fi Access Points (APs) in these buildings have been surveyed and the Wi-Fi AP location information will be made available to Consortium Members solely for use in the Consortium and by each Consortium Member's LTS that will be tested at the T&E event. Multiple tracks, each consisting of a set of floor markers, will be used to test each LTS.

By comparing the ground truth 3D coordinates of each floor marker with the estimate of the 3D location provided by the LTS under test, the estimation error can be computed and statistical analysis on the error done using the performance metrics specified in ISO/IEC 18305.

**Application Process:** Interested parties should contact NIST using the information provided in the ADDRESSES section. NIST will then provide each interested party with a letter of interest template, which the party must complete and submit to NIST. Each party's letter of interest must include the following information:

1. Whether the LTS to be tested is commercially available now or at an advanced productization stages so that it would be commercially available by the end of 2018.
2. Market the indoor LTS is targeting.
3. Given that large buildings will be used for testing, whether the number of units available to install in these buildings is sufficient for the system to go through a suite of tests, one building at a time. (As a point of information, the largest building to be used for testing covers 100,000 square feet of space.)
4. The willingness and ability to send an adequate number of staff members to install and uninstall the indoor LTS in test buildings and operate the equipment to administer the tests under NIST supervision for a period of about 3 days. If for any reason a LTS runs into technical problems and cannot complete the tests in each building in the allotted time slot, NIST has designated the last two days of the week as "make-up days", where tests that were not completed in their allotted

time slots can be redone. NIST will not be responsible for shipping equipment to NIST and back to your company.

5. Willingness to provide all data from T&E activities to the NIST Consortium Manager for purposes of this project.
6. A statement regarding whether the LTS requires deployment of equipment inside/outside a building in order to be tested; please specify the types of equipment that need to be deployed and how many per every 10,000 square feet of space.
7. If the LTS uses RF technology, please specify the frequency band(s) and power levels the LTS uses.
8. Whether the installation, uninstallation, or operation of the LTS is likely to cause damage of any type to the buildings or furnishing during testing.

Letters of interest may be submitted to the LTS Testing Consortium Manager electronically using the e-mail address provided in the ADDRESSES section. Letters of interest must include the name of the organization and the name and contact information for an official representing the organization. Letters of interest must not include any confidential information. NIST will not treat any information provided in the letters of interest as confidential or proprietary. NIST will review the letters of interest from each organization received prior to the closing date provided in the DATES section. Eligibility will be determined based on the information provided by the organization in response to the above request for specific information. NIST will notify an applicant in writing of its eligibility to participate in the LTS Testing Consortium. To participate, the eligible applicant will be required to sign a Cooperative Research and Development Agreement

(CRADA) with NIST. Each participant's CRADA will have identical terms and conditions that are consistent with the requirements of Title 15, United States Code, Chapter 63, Section 3710a (Cooperative Research and Development Agreements). NIST does not guarantee participation or any other collaboration to any organization submitting a Letter of Interest.

Authority: 15 U. S. C. § 3710a

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